METHOD FOR FORMING ACTIVATED ALUMINA COATING ON REFRACTORY ARTICLE AND ARTICLE THEREBY PRODUCED

BACKGROUND OF THE INVENTION

This application is a continuation-in-part of application Ser. No. 684,243 filed on May 7, 1976, now abandoned continued from application Ser. No. 466,074 filed May 1, 1974 now abandoned.

The present invention relates to a method for making a catalyst carrier for use in a catalytic converter for purification of a noxious waste gas and more particularly to a method for making a monolithic catalytic carrier for use in a catalytic converter for purification of exhaust gases from automobile engines.

As is well known, there has been hitherto proposed a refractory monolithic catalyst carrier for use in a catalytic converter of an exhaust purifying system, for example, of an internal combustion engine. This monolithic carrier is generally a solid, unitary body having a plurality of unobstructed openings therethrough in a direction of desired fluid flow. An example of such a shape of body is known as a honeycomb structure. In addition, the monolithic catalyst carrier is, in general, made of a refractory ceramic material such as mullite, cordierite, β-spodumene so as to endure elevated temperatures of the engine exhaust. For use as the catalytic converter, the monolithic catalyst carrier is usually impregnated with a catalytic component such as a platinum group metal by immersion; this monolithic carrier has disadvantages in that the carrier cannot securely carry a sufficient amount of catalytic component on the inner surface of the openings thereof because of its relatively low specific surface area and relatively low porosity or smooth, not rugged, surface. These disadvantages result in an unsatisfactory conversion efficiency of the catalytic converter for conversion of harmful components in the exhaust gases into harmless ones, and the poor durability of the catalytic component due to migration thereof from the surface of the carrier.

SUMMARY OF THE INVENTION

It is the prime object of the present invention to provide a method for making an improved catalyst carrier which contributes to the satisfactory conversion efficiency and the extreme durability of a catalytic converter using the catalyst carrier.

It is another object of the present invention to provide a method for making an improved monolithic catalyst carrier which can securely carry a relatively large amount of catalytic component on the surface thereof.

It is still another object of the present invention to provide a method for making an improved monolithic catalyst carrier having a surface with a relatively high specific surface area and relatively high porosity.

It is a further object of the present invention to provide a method for forming an improved high surface area coating on the surface of a monolithic catalyst carrier which coating is excellent in thermal durability.

It is still further object of the present invention to provide a method for preparing a catalyst for purification of a high temperature waste gas, which catalyst exhibits high performance even under an excessively high temperature condition.

It is a still further object of the present invention to provide a method for preparing a catalyst for purifying high temperature exhaust gases from automobile engines, which catalyst exhibits high conversion efficiency of noxious components contained in the exhaust gases even under an excessively high temperature condition.

Other objects, features and advantages of the present invention will be more apparent from the following description in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a graph showing variations in the specific surface areas of coating layers on catalyst carriers before and after a thermal durability test, in terms of varied amount of delta-alumina contained in activated alumina before coated on the carrier;

FIG. **2** is a graph showing the variations in the ratios of the specific surface areas after the thermal durability test to that before the same test, in terms of varied amount of delta-alumina contained in activated alumina before coating on the carrier;

FIG. **3** is a graph showing the conversion efficiencies of final catalysts, in terms of varied amount of delta-alumina contained in activated alumina before coated on the carrier; and

FIG. **4** is a graph showing the amounts of materials peeled off from the coating layers on the carriers, in terms of varied amount of delta-alumina contained in activated alumina before being coated on the carrier.

PREFERRED EMBODIMENTS OF THE INVENTION

In accordance with the method of the present invention, a mixture containing activated alumina and/or aluminum hydroxide and alumina sol is first prepared. The mixture is coated onto the surface of an available monolithic catalyst carrier or a carrier base. In this case, the alumina sol serves as a binder for adhesion of the activated alumina onto the surface of the catalyst carrier. The coated carrier is, after drying, fired by heating at an elevated temperature.

The monolithic catalyst carrier used in the present invention is a solid, unitary body having a plurality of unobstructed openings therethrough in a direction of desired fluid flow and is preferably of a size that permits occupancy by the body of at least a major portion of the cross-sectional area of the reaction zone to be employed. The carrier is constructed of a substantially chemically inert, rigid, solid material capable of maintaining its shape and strength at high temperatures, for instance up to 1100° C. The material includes ceramic materials such as mullite, cordierite, and β-spodumene. This refractory monolithic catalyst carrier is now commercially available in the open market.

Any kind of activated alumina which is commercially available is usable. Alternatively to the activated alumina according to the present invention, aluminum hydroxide may be used, which is produced by precipitation reactions between an aluminum salt and one of potassium hydroxide, sodium hydroxide, aqueous ammonia, sodium carbonate, ammonium carbonate etc. The aluminum hydroxide when used is finally converted into activated alumina by the firing step according to the present invention. The activated alumina or the aluminium hydroxide of the present invention is usually used not only in powder form but also in granule or pellet forms.

The alumina sol which serves as a binder for adhesion of the activated alumina and the aluminum hydroxide